STEPHEN AUSMUS (D930-2)

With Feedlot Manure, It Pay$ To Be Precise

Technician Todd Boman collects soil electrical conductivity readings as he drives through a vegetative treatment area. These values are used to generate maps illustrating nutrient distribution in the vegetative treatment area.

The same precision farming techniques that work with crops can work with manure management on cattle feedlots.

Agricultural engineers Roger Eigenberg and Bryan Woodbury and colleagues at the Agricultural Research Service Environmental Management Research Unit at the Roman L. Hruska U.S. Meat Animal Research Center in Clay Center, Nebraska, map the distribution of manure on the surface of feedlots and the flow of liquid manure in rain runoff.

This research could lead to both precision harvesting of manure and precision application of manure to crop fields, while controlling nutrient losses and gas emissions.

The scientists map manure distribution by towing a GPS-equipped sensor on a trailer pulled by an all-terrain vehicle over feedlot pens and cropland at about 6 miles per hour. The sensor estimates the amount and quality of manure in various places on the feedlot surface by measuring the manure's ability to conduct electricity.

Manure contains about 5 to 10 percent salt by dry weight, which comes from salt supplements in cattle feed. Salt in solution is an excellent conductor of electricity; therefore, dissolved salt in manure and manure-amended soils increases their electrical conductivity.

Eigenberg, Woodbury, and colleagues used a computer program called "ESAP," for Electrical Conductivity Spatial Analysis Program, to choose spots on the feedlots and a nearby hayfield to sample soils, rather than sample randomly. The U.S. Salinity Laboratory in Riverside, California, developed the program. Eigenberg and colleagues used the program to associate high soil conductivity levels with manure solids and with the chloride in the salts found in manure.

In more recent work, Woodbury, Eigenberg, and colleagues found that they could also use the program to correlate high soil conductivity with nitrogen, phosphorus, and the volatile fatty acids associated with manure odors.

In the earlier study, Eigenberg and Woodbury compared two experimental beef cattle feedlot pens at Clay Center—each having a very different, but common, management style—and found the correlations worked well in estimating the quantity and quality of manure solids on the feedlot floor in both pens.

The soil conductivity and modeling techniques could be used to help feedlot operators recover valuable byproducts from the feedlot. For example, manure with higher nitrogen and phosphorus content could be harvested for use as fertilizer. This would have the added benefit of reducing nutrient losses, and it could identify areas prone to odors so they could be treated with improved drainage or, possibly, with antimicrobial compounds.

Eigenberg and Woodbury also mapped a vegetative treatment area downslope of the Clay Center feedlot. Rain runoff from eight pens flows into a settling basin at the base of the feedlot. After the solids settle, the liquid manure flows through tubes onto a hayfield designed to capture and use manure nutrients.

The scientists could tell from the soil conductivity maps that the liquid manure was being unequally distributed. With this information, they made adjustments to the flow tubes, resulting in a more uniform distribution of the runoff and improved effectiveness of the treatment area.

"The idea is to have more of the nitrogen and phosphorus fertilizing hay than being lost to the environment," Eigenberg says. "This work will help improve techniques for handling manure on both feedlots and crop fields. Manure can be harvested for the greatest value possible, whether for energy or fertilizer, and used more efficiently, which should greatly reduce pollution and odors."—By **Don Comis,** ARS.

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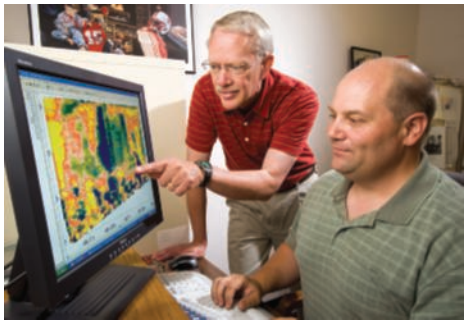
Agricultural engineers Roger Eigenberg (left) and Bryan Woodbury evaluate a soil electrical conductivity map of a vegetative treatment area.



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